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EXAMINER
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2621	

DATE MAILED: 07/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _6/16/2003_ .

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-6 and 10-23_ is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-6 and 10-23_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _3/08/2000_ is/are: a)☐ accepted or b)☒ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

    If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____ .

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

    a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _3_ .

4)☐ Interview Summary (PTO-413) Paper No(s). _____ .

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: .

DETAILED ACTION

Election/Restrictions

1.   The cancellation of claims 7-9 and 24-27 overcomes the examiners restriction

requirement cited in paragraph 1 of the previous office action. The applicant elected species I to

examine on the merits without traverse in paper no. 6, filed on June 16, 2003.

Drawings

2.   The drawings are objected to under 37 CFR 1.83(a). The drawings must show every

feature of the invention specified in the claims. Therefore, the method of claims 1-6 and 10-23

must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office

action to avoid abandonment of the application. The objection to the drawings will not be held

in abeyance.

Information Disclosure Statement

3.   The listing of references in the specification on pages 2-3 is not a proper information

disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other

information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may

not be incorporated into the specification but must be submitted in a separate paper." Therefore,

unless the references have been cited by the examiner on form PTO-892, they have not been

considered.

Claim Rejections - 35 USC § 102

4.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless —

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5.   Claims 1-3, 6, 11, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by

Sabata et al (B. Sabata and J. Aggarwal. Estimation of motion from a pair of range images: A

review. CVGIP, 54(3): 309–324, Nov. 1991.).

Referring to claim 1,

a.   Obtaining dense range data that describes the distance of points on the figure from

a reference is explained by Sabata et al on page 310, second column, third paragraph.

Sabata et al explain that the range image is the 3D coordinate of each point (or pixel)

sensed. A 3D coordinate inherently includes both the horizontal and vertical coordinates

of the object in space and also the distance of the object from the image sensor.

b.   Processing the dense range data to estimate the pose of the figure is explained by

Sabata et al on page 310, second column, third paragraph. Sabata et al explain that the

motion of a rigid object in an image is estimated, corresponding to the pose of the object

("pose determination" on page 309, first column, second paragraph).

Referring to claim 2, the dense range data being processed in accordance with a set of

depth constraints to estimate the pose is explained by Sabata et al on page 312, first column, first

and second paragraphs. Sabata et al explain on page 311, first column, forth paragraph that the

pose estimation is determined by both a rotational component (R) and a translational component

(T). Sabata et al then provide constraints to simplify the calculation of the rotation matrix to

estimate the rotational component of the pose estimation.

Referring to claim 3, the depth constraints being linear is explained by Sabata et al on page 311, first column, forth paragraph. Sabata et al explain that the rotational component of the pose estimation, which is constrained corresponding to claim 2, is a linear transform.

Referring to claim 6, the dense range data being compared with an estimate of pose to produce an error value and iteratively revising the estimate to minimize the error is explained by Sabata et al on page 311, first column, second and third paragraph. Sabata et al explain determining the error (E_{est}) of the motion estimations and minimizing the error.

Referring to claim 11,

a.   Obtaining dense range data that describes the distance of points on the figure from a reference corresponds to claim 1a.

b.   Processing the dense range data in accordance with a set of linear depth constraints to estimate the pose of the figure corresponds to claim 2.

Referring to claim 16,

a.   The estimate of the pose of the object including an estimate for each of the orientation and translational positions of the object is explained by Sabata et al on page 310, first column, forth paragraph. Sabata et al explain estimating the rotational component, corresponding to the orientation, and the translational component of the motion of an object.

b.   Decoupling the estimate of orientation from the estimate of the translational position is explained by Sabata et al on page 311, second column, first paragraph. Sabata et al clearly illustrate that the position of point on a succeeding frame is represented by the rotational component and the translational component independently.

6.   Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Kanade et al (U.S.

Patent No. 6,084,979).

Referring to claim 1,

a.   Obtaining dense range data that describes the distance of points on the figure from

a reference is explained by Kanade et al in column 7, lines 11-20. Kanade et al explain

that dense maps are used in motion estimation because of their usefulness in image

reconstruction.

b.   Processing the dense range data to estimate the pose of the figure is illustrated by

Kanade et al in figures 15a to 15l, wherein the pose of the figure in multiple successive

frames is estimated.

Claim Rejections - 35 USC § 103

7.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

8.   Claims 4-5, 10, 12-15, 17, and 21-23 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Sabata et al in view of Bregler et al (Bregler, C.; Malik, J. Tracking people

with twists and exponential maps. 1998 IEEE Computer Society Conference on Computer

Vision and Pattern Recognition, 23-25 June 1998. Page(s): 8 -15.).

Referring to claims 4, 10, and 15, obtaining brightness data in accordance with a set of

linear brightness constraints to estimate the pose is not explicitly explained by Sabata et al.

Sabata et al do explain that the intensity (corresponding to the brightness) of an image is widely

used in the art to determine the motion of an object on page 309, first column, second paragraph

to page 309, second column, first paragraph. However, Sabata et al do not explain linear

brightness constraints on the intensity data. Bregler et al do explain linear constraints on the

brightness data on page 9, first column, forth through seventh paragraphs. Bregler et al explain

constructing an over-constrained set of equations for the motion model, assuming that the motion

is linear. By applying the linearly constrained brightness data into the motion data determined

by the range data of Sabata et al, the motion of an object through a series of frames will be

estimated more accurately. Therefore, it would have been obvious to one of ordinary skill in the

art at the time the invention was made to use brightness data in accordance with a set of linear

brightness constraints to better determine the pose of an object.

Referring to claims 5 and 13, the depth constraints being represented by twist

mathematics is not explicitly explained by Sabata et al. However, Bregler et al do explain using

twist mathematics in order to estimate the pose of a figure on page 8, second column, first

paragraph. Bregler et al explain that using twist mathematics in motion estimation, such as the

estimation of Sabata et al, greatly simplifies the estimation and leads to a more robust tracking

result on page 8, second column, second paragraph. Therefore, it would have been obvious to

one of ordinary skill in the art at the time the invention was made to use twist mathematics as

suggested by Bregler et al in the motion estimation system of Sabata et al in order to perform the

motion estimation and object tracking more robustly.

Referring to claim 12, the object being articulated is not explicitly explained by Sabata et

al. However, Bregler et al do illustrate estimating the pose of an articulated object in figure 2.

The system of Sabata et al models the motion of an object by the rotational and translation

components of the object's movement. Thus, an articulated object could be efficiently tracked in

the system of Sabata et al. Therefore, it would have been obvious to one of ordinary skill in the

art at the time the invention was made to track an articulated object using the system of Sabata et

al.

Referring claim 14,

a.　　Mapping the parameters that describe the rotation and translation of the object to

a set of linear parameters is explained by Sabata et al on page 311, second column,

second paragraph. Sabata et al explain that the rotation and translation components of the

object movement are characterized by individual matrices.

b.　　Solving for the depth constraints is explained by Sabata et al on page 312, first

column, first and second paragraph. The rotational depth constraints are explained by

Sabata et al and used to estimate the object motion.

c.　　Re-mapping back to the original parameters to provide a pose estimate is

explained by Sabata et al on page 313, second column, fifth paragraph to page 314, first

column, first paragraph. Sabata et al explain that the parameters which determine the

rotational and translational components of the object are used in order to solve for the

motion of the object.

Referring to claim 17, the reference comprising a location on the object and the pose

being estimated from the positions of points on the object relative to the locations is explained by

Sabata et al on page 310, second column, sixth paragraph to page 311, first column, second

paragraph. Sabata et al explain determining the current position of an object (P') from the

previous position of the object (P) after the determined transformation of the object.

Referring to claim 21,

a.   Obtaining dense brightness data for pixels in each of the video images is explained by Sabata et al on page 309, first column, second paragraph.

b.   Obtaining dense range data for pixels in each of the video images corresponds to claim 1a.

c.   Determining an initial pose for the object in one of the video images is explained by Sabata et al on page 311, first column, forth paragraph by p, which is the initial point on an object undergoing a transformation.

d.   Estimating changes in at least one of the translational position and rotational orientation of the object for successive images on the basis of the brightness data and range data to estimate the pose of the object in successive images corresponds to claims 1b and 4, wherein the pose is determined using the range data and the brightness data, respectively.

Referring to claim 22, the object being articulated corresponds to claim 12.

Referring to claim 23, the estimates being obtained by means of linear constraint equations that are applied to the brightness data and the range data corresponds to claims 4 and 3, respectively.

9.   Claims 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sabata et al in view of Dubuisson-Jolly et al (U.S. Patent No. 6,195,445).

Referring to claim 18, the pose of an object being estimated for each image in a sequence of images and selecting a rigid translation value for each point on the object from one image to the next is not explicitly explained by Sabata et al. However, Dubuisson-Jolly et al do illustrate

rigid translation values for an articulated object in figure 4 by segment lengths Φ_1 to Φ_7 and explain polyline contours in column 6, lines 49-65. Dubuisson-Jolly et al explain that the polyline contours are tracked in an image sequence using an initial polyline contour in an input frame in column 6, lines 66 to column 7, line 10. By using the rigid translation value method of Dubuisson-Jolly et al, the processing required to track the motion of an articulated object would be reduced in the system of Sabata et al. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a rigid translation value for each segment of an articulated object in order to track the motion of an object more efficiently.

Referring to claim 19, the rigid translation value being an integer value corresponds to claim 18, wherein Φ_1 to Φ_7 may represent integer values of the rigid translation.

Referring to claim 20, the rigid translation values being different for different points on the object corresponds to clam 18, wherein each segment, D, has a specific and different rigid translation value Φ.

Conclusion

10.   The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

> Aggarwal et al (Aggarwal, J.K.; Cai, Q.; Human Motion Analysis: A Review.
> Nonrigid and Articulated Motion Workshop, 1997. Proceedings., IEEE , 16 June
> 1997 Page(s): 90 –102) – To exhibit tracking an articulated object using multiple
> techniques.
>
> Sasada et al (U.S. Patent No. 5,692,061) – To using a distance image to determine
> the position and posture of an object as illustrated in figure 1.

Darrell et al (U.S. Patent No. 6,445,810) – To exhibit range computation and

object detection as illustrated in figures 1 and 2.

Gibas (U.S. Patent No. 5,675,377) – To exhibit using a range image and intensity

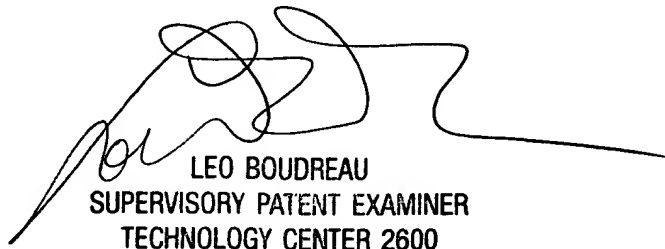image to determine a scene as illustrated in figures 4, 6, 19B, and 20.

11.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Hussein Akhavannik whose telephone number is (703)306-4049.

The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Leo H. Boudreau can be reached on (703)305-4706. The fax phone numbers for the

organization where this application or proceeding is assigned are (703)872-9314 for regular

communications and (703)872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding

should be directed to the receptionist whose telephone number is (703)305-3900.

Hussein Akhavannik
July 11, 2003

LEO BOUDREAU
SUPERVISORY PATENT EXAMINER
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